Fraser Timber Supply Area

Data Package

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1. Introduction

The data package for the Timber Supply Review program is a document which specifies the basic data inputs required to conduct a timber supply analysis.

The completed data package contains those inputs that are a part of current performance for the timber supply area. For the purpose of the timber supply review, "current performance" is defined:

- by the current forest management regime (e.g., the productive forest land available for timber harvesting, the silviculture treatments, the harvesting systems and the integrated resource management guidelines used in the area);
- by the standards used to approve or reject forest development (5-year development) plans;
- in fully implemented land-use plans;
- in land-use decisions approved by Cabinet;
- in approved higher level plans under the *Forest Practices Code*; and,
- in other approved B.C. Forest Service forest management practices and policy.

This idea of current performance should be kept in mind at all times when dealing with the data package. In other words, the purpose of the timber supply review program is to model "what is" not "what if". Changes in forest management objectives and data, when and if they occur, will be captured in future timber supply analyses.

2. Current Forest Management Considerations and Issues

2.1 Base case management assumptions

These assumptions reflect current performance with respect to the status of forest land, forest management practices and knowledge of timber growth and yield. The harvest forecast developed from these assumptions is termed the base case harvest forecast and is used as a reference to which other development seniors are compared. While there may be uncertainty associated with the assumptions used to develop the base case, these assumptions are qualitatively examined by conducting sensitivity analysis (see Section 7).

2.2 Statement of major forest management considerations and issues

The major forest management issues to be considered in this timber supply review are listed in the table below. Where issues are defined within legislation, regulations or standards, a timber supply assessment will be made. Issues and factors that are difficult to quantify or assess using a timber supply model may be either analysed separately or noted as upward or downward pressure on the timber supply.

Table 1. Major forest management considerations

Issue	Description
Stand and Landscape Level Biodiversity	Specific landscape unit (LUs) targets for wildlife tree retention have been implemented for all draft LUs based upon the *Biodiversity Guidebook* recommendations. Additionally, old-growth management areas (OGMA) in nine draft LUs which have been advertised. In the remaining LUs, forest cover requirements will be used to ensure representation of old forest characteristics in each biogeoclimatic variant.
Spotted Owl Management Plan	Modelling for owl habitat is based on the Chilliwack Forest District Spotted Owl Resource Management Plan (May 1999).
Ungulate Winter Range	Currently, ungulate winter ranges for deer and goats are depicted on ESA mapping. An initiative to update this information is underway. Once the new plan is approved it will be examined against the base case.
Grizzly Bear Recovery Plan	A Grizzly bear recovery plan is still in draft form. Once approved, it will be incorporated into a future timber supply review. The impact on timber supply resulting from the draft plan is expected to be neutral.
Community Watershed	The recommendations found in the *Community Watershed Guidebook* will be modelled.
Updated Visual Landscape Management	Modelling will include the recommended visual quality classes.
Variable Retention and Partial Harvesting	The reduced yields associated with the increased use of the partial retention silvicultural system will be modelled. The research branch within the Ministry of Forests is currently developing some estimates regarding regeneration impacts associated with these practices.

(continued)

Table 1. Major forest management considerations (concluded)

Issue	Description
Shifting Harvest Profiles	Within the Fraser Timber Supply Area there is an ongoing shift in harvest profile from old growth Hemlock/Balsam to second growth Douglas-fir forests. The influence on long-term productivity with increased harvesting of second-growth stands and the associated influence of minimum harvest ages will be examined.
New Fraser Vegetative Resources Inventory	A new air photo based forest inventory has been completed and compiled for use in the timber supply analysis.
Riparian Management	A predictive geographic classification model will be used to identify the appropriate level of management in riparian areas.
Archeological Sites and Traditional Use	The Archeological Predictive Model mapping is considered as a work in progress and is used to provide direction for operational planning. There has been a number of field checks and archeological impact assessments that have been completed to date and confirmed sites have been registered with the Archeological Branch.
Urban Forestry Interface Areas	This timber supply review will monitor harvesting activities in the forest land not in provincial forest adjacent to urban areas.
Cutblock Size and Adjacency	A forest cover requirement will be used for the base case however sensitivity analysis setting maximum cutblock sizes will also be examined.

3. Inventories

3.1 Background information

The following data sources will be consulted during this timber supply review.

Table 2. Inventory information

Data	Source	Vintage	Update	Scale
Forest cover — FC1	MoF	1970-74	2001	1:20000
Forest cover — VRI	MSRM	1996	2001	1:20000
Updated Recommended Visual Quality Classes	MoF	1996	2001	1:20000
Draft Landscape Unit Boundaries	MSRM	1996	1996	1:20000
Draft Old-Growth Management Areas	MSRM	2002	2002	1:20000
Operability mapping	MoF	1996	1996	1:20000
Archeological Data — Known sites only	MoF	1997-2001	2001	1:50000
Consolidated FDP	MoF	2001	2001	1:50000
Community Watershed	WLAP	1997	N/A	1:20000
Spotted Owl SRMZ and Matrix Areas	MSRM	1999	1999	1:20000

Data source and comments:

A new vegetation resource inventory (VRI) has been completed for the Fraser TSA based on 1996 aerial photography. The new VRI file has been updated with logging information to 2000 (NSR – Not Satisfactorily Stocked and all areas with opening history under 45 years of age). Information from the previous forest cover maps (i.e., FC1) were used for this process. Note that the new Fraser TSA VRI does not include all of the historical information that has been traditionally recorded on the FC1 coverage. Phase 2 of the VRI involved the establishment of ground sample plots to determine the accuracy of the photo-interpreted labels established during phase 1. The specific age, height and volume adjustment factors applied to each species group and the associated statistical data can be obtained from Ministry of Sustainable Resource Management in Victoria.

Currently, five LUs have had OGMAs advertised for public review (Ainslie, Anderson, Mehatl, Nahatlatch, Spuzzum) and an additional four (Coquihalla, Manning, Silverhope, Yale) are in draft stage.

The operability mapping has been adjustment to include all logged areas or areas in the Forest Development Plan that were previously considered inoperable.

As the VRI maps contain only vegetation data, local information needed for analysis such as operability mapping, environmentally sensitive areas (ESA), were merged with the VRI file to produce a set of resultant data files for use in the timber supply analysis. This local information is available in digital format from the Ministry of Forests, Chilliwack Forest District upon request.

4. Division of the Area into Management Zones

4.1 Management zones and tracking of multiple objectives (grouping)

The concept of management zones is used to differentiate areas with different management objectives. For example, a zone may be defined as an area which has a common harvesting system, silviculture system, or visual quality objective. The computer simulation model enables the tracking of multiple objectives on the forested land base. In addition, the non-contributing forest (land considered unavailable for timber harvesting) may be included for consideration in attaining forest cover objectives. Grouping enables forest management constraints to be apply to different combinations of variables or zones. Groups may be thought of as layers of different objectives, which must be tracked over time. Further information on the forest cover requirements to be applied to these areas can be found in Section 6.4.

Table 3. Objectives to be tracked

Objectives	Inventory Definition
Cutblock adjacency only	No rVQC or NVA (non-visual areas assigned).
RVQC	The new rVQC code are: R, PRL, PRM and PRH, and M.
Deer and goat winter range	ESA_W (D or G).
Second-growth harvesting	Above the minimum harvest age and younger than 105 years old. (Current stands < 105 years will be called second growth).
Harvesting in fir	All fir-leading analysis units.
Spotted owl SRMZs and matrix areas	SRMZ numbers indicated on spotted owl SRMZ mapping. Within SRMZs there are: Long-term owl habitat (LTOH), Forest Management Areas (FMA) and Replacement Areas (RPA). Outside of the SRMZ areas are matrix areas which require some harvest sequencing.
Community watersheds	Community watershed numbers indicated on mapping.
Urban Interface areas	Crown forests that are outside provincial forest.
Draft landscape units, biodiversity emphasis options and biogeoclimatic variants	Draft BEO and BEC indicated on mapping. Limited OGMA mapping is available (9 LUs).
Heli-logging	Operability code 'H'.

4.2 Analysis units

An analysis unit represents a combination of stands, dominated by a specific tree species, which have the same timber growing capability. Each analysis unit is assigned its own timber volume projections (yield tables) for existing and future stands.

Yield tables for existing natural stands are derived using the variable density yield projection (VDYP) model. Yield tables for recent plantations and future stands are derived using the table interpolation program for stand yields (TIPSY).

Table 4. Definition of analysis units

Analysis Unit	Inventory Type Groups	Description
Fir – SI less than 17.4	1 — 8	< 17.4
Fir – SI 18 to 34	1 – 8	1 metre increments
Fir – SI 35+	1 – 8	> 34.5
Cedar – < 101 years	9 – 11	All sites
Cedar – 100+ years	9 – 11	All sites
Hemlock/Balsam – SI less than 10.4	12 – 20	< 10.4
Hemlock/Balsam – SI 10 to 29	12 – 20	1 metre increments
Hemlock/Balsam – SI 30+	12 – 20	> 29.5
Pine/Larch	27 – 31	All sites
Spruce	21 – 26	All sites
Alder	37 – 38	All sites

Data source and comments:

All site index ranges are draft and will be finalized once the data set for the analysis has been produced.

For Fir and Hemlock/Balsam stands, analysis units are created for each one metre increment in site index.

The site index refers to the height of the tree in metres when its breast height age is 50 years.

5. Timber Harvesting Land Base Definition

5.1 Identification of the timber harvesting land base

This section outlines the steps used to identify the timber harvesting land base (THLB) (i.e., the productive forest expected to support timber harvesting) within the Fraser timber supply area. Land may be unavailable for timber harvesting for three principle reasons:

- it is not administered by the Forest Service for timber supply purposes (e.g., private land, parks, etc.);
- it is not suitable for timber production purposes (e.g. non-forested areas); or
- it is unavailable for timber harvesting (e.g. recreation areas).

Land may also be added to the timber harvesting land base:

- by management activities which improve productivity or operability (e.g., the stocking of land currently classified as non-commercial brush); or
- by the acquisition of productive forest land (e.g., timber license reversions).

The timber harvesting land base for the Fraser TSA is determined by separating out the following areas, which do not contribute to timber harvesting in the area:

- land not administered by the forest service for the purpose of timber supply.
- non-forest types.
- environmentally sensitive areas (ESA).
- inoperable forest.
- sites with low timber growing potential.
- unmerchantable forest types or problem forest types.
- roads, trails and landings.
- specific known cultural heritage resources which result in areas being unavailable for timber harvesting.
- riparian management areas. These include riparian reserve and management zone considerations.
- specific wildlife habitat areas considered unavailable for timber harvesting.
- Spotted Owl long-term habitat. See Section 6.4.1.
- sites with adequate productivity but possessing low projected volume.
- specific old-growth management areas. See Section 6.4.1.
- wildlife tree retention. See Section 6.4.2.

The above categories apply to land where no harvesting is anticipated to occur. Forest cover requirements are used in cases where forest management objectives are known.

After all the areas that do not contribute to the timber harvesting land base have been identified, additional lands may be added to the land base (e.g., not satisfactorily restocked areas that have been successfully reforested). The resulting productive forest land base is defined as the current timber harvesting land base for the TSA.

5.2 Details on land base classification

5.2.1 Land not administered by the BCFS for timber supply purposes

Ownership codes are generally used to identify land that contributes to the timber supply. Ownership codes 62C and 69C indicate Crown land in a forest management unit and miscellaneous reserves respectively. These are generally the only ownership codes which are considered to contribute to the timber supply. Ownership code 70N, timber license land in a TSA is considered under Section 5.2.14.

5.2.2 Land classified as non-forest

Areas such as alpine forest, wetland, lakes, rocks, shrubs etc. are removed from the timber harvesting land base. Within the new vegetation inventory, stands considered non-vegetated or vegetated but without significant tree cover (VN) are considered non-forest. The exception is areas that were classified as bare ground or have little tree cover due to previous logging. This additional information was obtained from the FC1 inventory.

5.2.3 Environmentally sensitive areas

An environmentally sensitive area (ESA) is an area that is susceptible to disturbance (e.g., unstable terrain, or areas that are difficult to reforest) or is significantly valuable for fisheries, wildlife, water or recreation. ESA values are used to exclude areas from the timber harvesting land base where more specific and detailed information is not available about a particular forest resource. Areas can be identified as either very sensitive (E1) or moderately sensitive (E2) to disturbance, and are entirely or partially removed from the timber harvesting land base.

Table 5. Description of environmentally sensitive areas

ESA Category	ESA Description	Reduction (%)
S1	Highly sensitive soils	100
A1	Avalanche hazard	100
P1	Severe regeneration problems	100

Data source and comments:

The removal of S2 areas (moderate sensitive soils) was also considered ,however, exclusion of these areas for other reasons, such as low site productivity, has already eliminated most of the S2 areas from the timber harvesting land base. Given that some timber harvesting does occur in S2 areas, a decision was made to retain the remaining S2. This will also off set the 10% of ESA S1 areas that were previously included in TSR 2 and are now completely removed from the timber harvesting land base.

5.2.4 Areas considered inoperable

Operability codes are generally used to describe the presence or absence of physical and economic barriers that limit harvesting. Since physical and economic conditions are highly variable throughout British Columbia, interpretation and mapping of these areas is susceptible to change. The following reductions will be applied to account for operability.

Table 6. Description of operable areas

Inventory Description	Code	Reduction (%)
Operable Areas — conventional	A	0
Operable Areas — helicopter	H	0
Inoperable	I	100

Data source and comments:

Inoperable areas with a logging history and all of the areas that are shown in the 2001 version of the consolidated Forest Development Plan are now considered to be operable.

5.2.5 Sites with low timber growing potential

Sites may have low productivity either because of inherent site factors (e.g., poor nutrient availability, exposure, excessive moisture, etc.), or because they are not fully occupied by commercial tree species. Typically, these stands are intermixed with other stands within the forested land base. As these stands are not considered to be harvestable, they need to be identified and removed from the timber harvesting land base. This will be done as outlined in Table 7.

Table 7. Description of sites with low timber growing potential

Leading Species	Characteristics	Reduction (%)
Fir	Existing volume less than 350 m³/hectare and SIBHA50 less than 16 metres (projected not to produce 350 m³/hectare by age 150 years). In heli-log areas (operability ="H") volume and SI criteria will be based on achieving 400 m³/hectare.	100
Cedar	Existing volume less than 350 m³/hectare and SIBHA50 less than 13 metres (projected not to produce 350 m³/hectare by age 150 years). In heli-log areas (operability ="H") volume and SI criteria will be based on achieving 400 m³/hectare.	100
Hemlock/Balsam	Existing volume less than 350 m³/hectare and SIBHA50 less than 11 metres (projected not to produce 350 m³/hectare by age 150 years). In heli-log areas (operability = "H") volume and SI criteria will be based on achieving 400 m³/hectare.	100
White spruce (FIZ D)	Existing volume less than 300 m³/hectare and SIBHA50 less than 11 metres (projected not to produce 300 m³/hectare by age 150 years). All heli-log areas (operability = "H").	100
Sitka spruce (FIZ A,B,C)	Existing volume less than 350 m³/hectare and SIBHA50 less than 11 metres (projected not to produce 350 m³/hectare by age 150 years). In heli-log areas (operability = "H") volume and SI criteria will be based on achieving 400 m³/hectare.	100

(continued)

Table 7. Description of sites with low timber growing potential (concluded)

Leading Species	Characteristics	Reduction (%)
Pine	Existing volume less than 300 m³/hectare and SIBHA50 less than 13 metres(projected not to produce 300 m³/hectare by age 150 years). All heli-log areas (operability = "H")	100
Alder	Existing volume less than 150 m³/hectare	100

Data source and comments:

Areas with a low timber growing potential that have been logged or are scheduled for logging in the current Forest Development Plan will not be removed from the timber harvesting land base.

5.2.6 Unmerchantable forest types

Problem forest types are stands which are physically operable and exceed low site criteria yet are not currently utilized or have marginal merchantability. These types are wholly or partially excluded from the timber harvesting land base. Examples of these types of stands are, deciduous types, balsam, cedar and hemlock stands that contain a high proportion of decadent wood or pine stands with a very high stand density.

Table 8. Unmerchantable forest types criteria

Leading Species	Inventory Type Group	Reduction (%)
Cottonwood Aspen, Birch, Maple	35, 36, 39, 40, 41, 42	100

5.2.7 Roads, trails and landings

In this analysis, the GIS was used to assign a 7.5 metre buffer to either side of all roads. This represents an average for roads, trails and landings. The buffered area will be removed from the polygons in which it occurs.

For future roads, a review of logging since 1996 showed that the road network represents about 5% of logged areas. Therefore all pixels above 120 years of age that are not currently roaded will have a 5% reduction applied. This will be reviewed upon completing the inventory file preparation.

5.2.8 Wildlife habitat reductions

Only one small 50 ha area has been established. Due to its small size, this area will not modelled as part of this timber supply review.

5.2.9 Cultural heritage resource reductions

Cultural heritage values includes archaeological sites will be managed according to Table 9.

Table 9. Cultural heritage resources

Identified Inventory Variables	Excluded Area (ha)
Known archaeological feature	1 ha per occurrence within a forest cover polygon

5.2.10 Riparian reserve zones

The information to be used in this analysis to capture the effects of riparian management zone on the timber supply is dealt with in Section 6.4.2 and was created by Marvin Eng, Landscape Ecologist with MoF Research Branch.

A coverage of all the TRIM water features was obtained from the District database. Extracting the following features created a separate coverage for each type of water feature to be used in the analysis:

Table 10. Riparian features and description

Riparian feature	Description
Double line river	Left bank/right bank
Lake	Definite/indefinite/intermittent
Marsh	Marsh outline/swamp outline
Island	Outline
Single line river	Definite/indefinite/intermittent

The coverage for double line rivers, lakes, marshes and islands were formed into polygons. The island coverage was overlaid with the lake and double line river coverage to form a water feature coverage that included the appropriate islands.

The lake coverage was overlaid with the biogeoclimatic subzone/variant map. Lakes were classified into L1 – L4 categories based on area and biogeoclimatic zone as outlined in the *Riparian Management Guidebook*. The same process was used to classify marshes into categories W1 – W4. In a separate process wetland complexes (W5) were identified. This process involved producing 60 and 80 metre buffers around appropriately size wetlands and determining which of those wetlands and their buffers formed a "complex".

Rivers were classified as follows. All double line river polygons were assumed to be S1 rivers. The polygons were buffered internally to determine their width. The result was used to distinguish "very large rivers – S1L" (i.e., > 100 metres in width as specified in the *Riparian Management Guidebook*). Only the lower portion of the Fraser River starting about 10 kilometres upstream of Hope fell into this category.

Single line rivers are classified using the slope of the stream reach and the distinction between definite/indefinite and intermittent streams. The 25 metre grid digital elevation model (DEM) was used to create a slope layer for the study area. This was formed into polygons with slopes either greater than or less than and equal to 20%. The slope attribute was attached to the single line water features and they were classes as follows:

Table 11. Stream class categories

Stream Class	Single Line Water Type	Slope Class
S2/S3	Definite & Indefinite	< 20%
S4	Intermittent	< 20%
S5	Definite & Indefinite	>= 20%
S6	N/A	N/A

Having classified the lakes, marshes and rivers into the riparian management guidebook classification system buffers were produced around the features that represent the riparian management area The following table outlines the widths that are recommended in the *Riparian Management Guidebook*.

The calculated width, based on the *Riparian Management Guidebook*, differs from the implemented width for stream classes S3 to S6. This difference is based on discussions with and recommendations from Peter Tschplanski (MoF Research Branch – Fish/Forestry interactions). There is no GIS method to distinguish between S2 and S3 streams so the S2 width was applied to both classes. It was assumed that S4 and S5 were under represented in TRIM maps compared to their actual occurrence on the landscape and we increased the width of the buffer to compensate for this underestimate. No S6 streams were identified. S6 streams were not explicitly included in the riparian management zone delineation. However, the land base implications of best management practices on S6 streams are considered to be negligible.

Table 12. Recommended and implemented riparian management area widths

Feature Class	Reserve Zone Width (m)	Management Zone Width (m)	Management Zone Retention (%)	Calculated RMA Width (m)	Implemented RMA Width (m)
S1L	0	100	50	50	50
S1	50	20	50	60	60
S2	30	20	50	40	40
S3	20	20	50	30	40
S4	0	30	25	7.5	10
S5	0	30	25	7.5	10
S6	0	20	5	1	N/A
L1	10	0	25	10	10
L2	10	20	25	15	15
L3	0	30	25	7.5	7.5

(continued)

Table 12. Recommended and implemented riparian management area widths (concluded)

Feature Class	Reserve Zone Width (m)	Management Zone Width (m)	Management Zone Retention (%)	Calculated RMA Width (m)	Implemented RMA Width (m)
L4	0	30	25	7.5	7.5
W1	10	40	25	20	20
W2	10	20	25	15	15
W3	0	30	25	7.5	7.5
W4	0	30	25	7.5	7.5
W5	10	40	25	20	20

5.2.11 Old growth management area considerations

In the Fraser TSA, there are five landscape units (Ainslie, Anderson, Mehatl, Nahatlatch, and Spuzzum) where old-growth management areas (OGMA) have been identified and the public review period of the higher level plan has ended and an additional four are in the final stage of preparation before being released for public review (i.e., Coquihalla, Manning, Silverhope and Yale). For the base case, it will be assumed that these areas satisfy all old-seral biodiversity requirements in these units and the OGMAs will be considered unavailable for timber supply. Landscape units where OGMA delineation has not reached this advanced stage will have the old seral targets described in Table 21, Section 6.4.1 applied.

5.2.12 Sites with adequate timber growing potential but insufficient projected volume

In some areas of the TSA, the growth potential of the site indicates that with sufficient stocking, a merchantable volume will be achieved. However, given that there are multiple forest cover attributes used to project standing volume, an additional consideration has been used. Stands under 150 years of age will be evaluated for their ability to attain the volumes found in Table 7. Any stands not projected to attain this volume will be excluded from the timber harvesting land base.

5.2.13 Long-term spotted owl habitat

In keeping with the Spotted Owl Resource Management Plans released in May 1999, area assigned to long-term owl habitat (LTOH), representing approximately 67% of all spotted owl special resource management zones, is assumed to be unavailable for harvest. The plan allows 1/3 of the volume on 1/3 of the area to be harvested in order to improve spotted owl habitat. There is no time specified for this harvest to occur. The volume resulting from this activity, however, was considered to be too small to require incorporation in the timber supply analysis.

5.2.14 Timber license reversions

Timber Licenses are old tenure arrangements that give a licensee exclusive rights to harvest merchantable timber within the license area and do not contribute to the TSA allowable annual cut. Once these areas have been harvested, regenerated and attain free-growing status, the timber license area reverts to Forest Service jurisdiction. Accordingly, these areas are included in the timber harvesting land base after the first harvest and contribute to the TSA harvests in mid- to long-term timber supply.

For the purposes of this timber supply review it is assumed that one half of the outstanding timber licenses will be harvested by 2006 while the other half will be revert to the Crown by 2011. Outstanding timber licensees will be defined as stands with an ownership code of 70 which are at least 103 years old Timber license areas that are younger than 103 years are assumed to have already been harvested and reverted for the purpose of this analysis.

When a timber license area reverts to the Crown, it will retain in its original resource emphasis and analysis unit.

6. Current Forest Management Assumptions

6.1 Harvesting

6.1.1 Utilization levels

Utilization levels define the maximum stump height, minimum top diameter (inside bark) and minimum diameter at breast height that will be used to calculate merchantable volume.

Table 13. Utilization levels

Leading Species	Minimum dbh (cm)	Maximum Stump Height (cm)	Minimum Top dib (cm)
Pine/larch	12.5	30	10
White Spruce	12.5	30	10
All others – < 121 years	12.5	30	10
All others > 121 years	17.5	30	15

Data source and comments:

The volume compilation used in the inventory adjustment process reflected the utilization standards detailed in Table 13. The VDYP, however, will only provide data based upon 17.5 cm minimum dbh. It is assumed that the adjustment factors derived with the appropriate utilization will incorporate the volume differences between these two standards.

6.1.2 Minimum harvestable age

Analysis units are developed to achieve management objectives through groupings of stands with similar species associations, levels of productivity and growth characteristics. Minimum harvestable ages can be defined by a product goal which achieve "optimal" stand level management. Remember that these are simply minimum criteria. While harvesting may occur in stands when the minimum requirements are achieved, some stands may not be harvested until well past "optimal" timber production ages in order to accommodate other resource values (e.g., requirements for the retention of older forest).

Table 14. Minimum harvestable age criteria and desirable stand condition

Analysis Unit	Estimated Age for 250 Largest Stems to Reach 30 (cm)	Volume M^3 (Heli minimum M^3)	Minimum Harvestable Age	Culmination Age	% of CMAI at Minimum Harvestable Age
Fir < 20		350			
Fir 21+		350 (400)			
Cedar – All Sites		350 (400)			
Hemlock/balsam < 14		350			
Hemlock/Balsam 15+		350 (400)			
Pine/Larch		300			
Spruce		350			
Alder		150			

Data source and comments:

With the implementation of the second growth strategy, emphasis has been placed on the harvesting of younger stands. Table 14 is intended to outline the consequences of harvesting certain stand types earlier than the age of maximum volume growth and the volume reduction incurred if such a strategy were consistently applied. **Minimum harvestable age is not intended to dictate actual operational harvesting practice.**

6.1.3 Harvest scheduling and targets priorities

The Chilliwack Forest District has implemented a management strategy of shifting the timber harvest towards second growth. This provides for an increase in the available harvest planning area for licensees, a reduced activity in the remaining older forests and an increase in the opportunities to use existing infrastructure for harvesting (i.e., existing road networks). Second growth also tends to be at lower elevations where the gentler terrain characteristics reduce harvesting costs.

Concentric circles represent areas outside the special resource management zones but within spotted owl matrix areas. These are circular.

Table 15. Priorities for scheduling the harvest

Description	Analysis Unit	Period (10 year increments)	Priority 1 – 100 or Minimum Harvest Level
2nd growth	Stands under 105 years of age	First 20 years	Min 20%
Concentric circles	Stands in the Spotted Owl matrix areas		Harvesting stands further away from the centre of the matrix area before stands in the centre of the matrix

6.1.4 Logging method

Conventional logging methods (i.e., cable, grapple, skidder) are the dominant harvesting systems within the Fraser Timber Supply Area. Heli-logging is employed but no specific volume target has been assigned to this method of extraction. Heli-logging volumes will be monitored separately during this timber supply review.

6.1.5 Silvicultural systems

Although the majority of the timber supply area will be clearcut, the Chilliwack Forest District has been practicing variable retention (VR) silviculture for the last several years. Estimates of the per cent of volume being retained are not currently available but will be gathered in time to be incorporated in the analysis. The research branch of the Ministry of Forests has begun providing estimates of the expected volume reductions associated with the adoption of this silvicultural system. At this point, it is assumed that area designated as VR reserves will be permanent.

6.2 Unsalvaged losses

Table 16 shows the estimated average annual unsalvaged volume loss due to catastrophic events such as insect epidemics, fires, wind damage or other agents. The unsalvaged loss column only reflects those areas in which the volume will not be recovered.

Table 16. Unsalvaged losses

Cause of Loss	Total Loss (m^3/year)	Annual Unsalvaged Loss (m^3/year)
Fire	17 000	15 925
Wind damage	31 500	2 500
Total	48 500	18 425

Data source and comments:

Based on the *1992 Insect and Disease Report* the average area lost to wind damage is 90 hectares per year. The average volume within the Fraser Timber Supply Area is 350 cubic metres per hectare thus, the total projected volume loss is 31 500 cubic metres. On average about 29 000 cubic metres per year is salvaged, therefore the unsalvaged losses attributed to wind is 2500 cubic metres per year.

6.3 Silviculture

6.3.1 Regeneration activities in managed stands

Recent plantations and future stands will be grown on managed stand yield tables (MSYTs) produced using the Forest Service TIPSY growth and yield model. The table below contains the inputs required to produce MSYTs for this analysis. A MSYT may be built from a number of tables if more than one regeneration method is used within an analysis unit. When this is the case, tables are produced for the different regeneration methods (each method x species combination) are then aggregated into one table.

Table 17. Regeneration assumptions by analysis unit

Analysis unit			OAFs		Method		Species		
	Site index	Regen delay	1	2	Type	%	Code	%	Density
Fir leading	< 20	2	15	5	Plant	100	Fd	100	1200
Fir leading	21+	3	15	5	Plant	100	Fd	100	1200
Cedar – < 100 years	All	2	15	5	Plant	100	Cw	100	1200
Cedar – 100+ years	All	3	15	5	Plant	100	Cw	100	1200
Hemlock/Balsam	< 14	4	15	5	Natural	100	Hw	100	1700
Hemlock/Balsam	15-21	3	15	5	Natural	100	Hw	100	1700
Hemlock/Balsam	> 21	2	15	5	Natural	100	Hw	100	1700
Pine/Larch	All	2	15	5	Plant	100	Pl	100	1200
Spruce	All	3	15	5	Plant	100	Sw	100	1200
Alder	All	2	15	5	Plant	100	Fd Dr	75 25	1200

Data source and comments:

Each row describes the stand conditions to be applied to all analysis units in the respective SI range.

The VRI shows that average live stem densities in young hemlock/balsam stands is about 1700 per hectare. Natural regeneration with fill planting of gaps is the general regeneration method in hemlock/balsam stands.

6.3.2 Immature plantation history

This section identifies areas of existing immature forest where the density (i.e., stems per hectare) is controlled and therefore should be assigned to a managed stand yield table curve (MSYT). All NSR and stands harvested in the future will be managed under MSYTs.

Table 18. Immature plantation history

Analysis Unit	Stand Age at which MSYT will be Applied
All Douglas-fir	<= 35 years
All Hemlock/Balsam	<= 25 years
All cedar	<= 15 years
All pine/larch	<= 15 years
All spruce	<= 15 years

Data source and comments:

These criteria will be reviewed against the silviculture history information derived from the FIP files.

6.3.3 Not satisfactorily restocked (NSR) areas

Land classified in the TSA FIP file as type identity 4 or 9 is included in the current timber harvesting land base. These type identities indicate old cutblocks which have not yet reached free-growing status. The FIP and VRI both show previously forested land without trees or land which has been recently planted. In the FIP, the type identity will be used to identify recent logging not contained in the VRI but also to provide stand ages for areas in the VRI which were photo-interpreted as bare ground (recently harvested) or vegetated but having no trees. Stand age from the FIP has been overlaid with the VRI to provide a harvest depletion update. NSR from the FIP will be given an age based on standard regeneration delay and logging year (e.g., Current Year 2001 – Logged Year 1996 – Regeneration Delay 2 years = Stand Age 3).

6.3.4 Fertilized areas

Fertilization information from the FIP (2002) file was extracted as a spatial coverage to indicate which stands should receive an increase in stand volume due to this treatment. This increase will be applied to these stands in the timber supply model as opposed to the yield tables.

6.3.5 Genetic gain through tree improvement

Data from the Tree Improvement Branch of the Ministry of Forests indicate that Class A seed has been employed for Cedar, Fir and Spruce stands. On average, this seed produces a genetic gain of 2%. Seed with higher genetic worth is becoming available but seed use cannot be adequately projected for use in the base case timber supply analysis. The relative per cent of Class A seed use by species against all planting activity is listed below.

Table 19. Per cent class A seed use by year

Species	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
CW	0	0	2	12	11	18	21	25	22	26	15
FD	1	12	8	58	63	89	70	92	84	83	73
SX	0	0	9	0	14	0	12	44	63	54	74

6.4 Integrated resource management

6.4.1 Objectives which require forest cover requirement

As noted in Section 4.1, the discussion on multiple objectives and forest cover requirements may be examined at a number of different levels. These may be considered as layers in GIS terminology. One possible layer may be landscape units, another may be wildlife areas, while another may be associated with a different resource emphasis. With the requirement to retain different forest characteristics across the landscape, it is important to identify how non-contributing forest (productive forest which does not contribute to the timber harvesting land base) may be considered in the forest cover requirements (i.e., maximum allowable disturbance or minimum area retention). Table 20 details the groups to be tracked during this timber supply review.

Table 20. Forest cover requirements

Group	Maximum Allowable Disturbance (%)	Green-up Height or Age	Minimum Retained Area (%)	Minimum Age or Height for Retention	Area of Application
IRM	25	3 m			THLB within an LU outside of visual areas
RVQC= R	3	5 m			Forested area in a visual polygon
RVQC=PR_L	15	5 m			Forested area in a visual polygon
RVQC=PR_M	10	5 m			Forested area in a visual polygon
RVQC=PR_H	6	5 m			Forested area in a visual polygon
RVQC=M	20	5 m			Forested area in a Visual polygon
Deer WR			Existing % of Deer WR in an LU	100 years	THLB with similar aspect and leading species in an LU
Goat WR			Existing % of Goat WR in an LU	100 years	THLB with similar aspect and leading species in an LU
Community Watershed	5	5 years			
Spotted Owl habitat			LTOH (RPA+LTOH)	100 years	Long term owl habitat + Replacement area in each activity centre

Data source and comments:

The IRM objective is a surrogate for cutblock adjacency. Recommended visual quality class (rVQC) have been assigned by the Chilliwack Forest District manager. Community watershed guidelines are taken from the *Forest Practices Code Community Watershed Guidebook*. Spotted owl management guidelines have been extrapolated from the Spotted Owl Resource Management Plan that identifies the current owl habitat with the goal towards releasing the replacement areas (RPA) with suitable LTOH as stands in the LTOH become 100 years of age.

All stand heights shown in Table 20 refer to top heights (inventory definition), not average stand heights.

For nine landscape units in the Fraser TSA, the old-growth management areas have been specifically identified and advertised or are soon to be advertised. For all other landscape units, the biodiversity guidelines with the draft biodiversity emphasis option will be modelled based on the old-seral requirements found in the *Forest Practices Code Biodiversity Guidebook*. For low biodiversity emphasis option areas, a recruitment strategy will be put into place, if required, to ensure that the old-seral objective are achieved by the end of the third rotation. Forest cover requirements are determined for each BEC variant within each landscape unit.

Table 21. Landscape unit old seral forest cover requirements

Disturbance Type	BEO	Old Growth Requirement (%)	Starting in Year		
			1	70	140
NDT 1	L	13	4.3	8.6	13
	I	13	13	13	13
	H	19	19	19	19
NDT 2	L	9	3	6	9
	I	9	9	9	9
	H	13	13	13	13
NDT 3	L	14	5	10	14
	I	14	14	14	14
	H	21	21	21	21
NDT 4	L	13	4.3	8.6	13
	I	13	13	13	13
	H	19	19	19	19

Data source and comments:

In natural disturbance types (NDTs) 1, 2 and 4, old seral forest is defined as stands older than 250 years. In NDT 3, old seral forest is defined as stands older than 140 years.

6.4.2 Reductions to reflect volume retention in cutblocks

Wildlife tree retention values for each LU/BEC variant have been developed and are shown in Table 22 below. The numbers were derived from Table 20b of the *Biodiversity Guidebook* which assumes a higher requirement of wildlife tree retention (WTR) where OGMAs have not been assigned. Table 20a is to be used when OGMAs are in place. The timber supply analysis will use the newly assigned OGMAs in 5 landscape units and dynamically create OGMAs during the simulation so it is appropriate for the analysis to reduce the numbers found in this table by 3%. This reduction reflects the difference between Table 20b and Table 20a of the *Biodiversity Guidebook*. This procedure does not affect the current operational requirements for licensees to leave a higher WTR until OGMAs are officially designated.

A GIS exercise was used to reduce the area of THLB where WTR must occur. This exercise delineated a 200 metre buffer around forested stands that are not considered part of the THLB. It is assumed that this buffer meets all of the requirements for WTR and therefore additional contributions are not needed. In the model, the WTR policy will be randomly assigned to creating various size reserves. Any WTR under two hectares in size will not contribute to biodiversity. Examination of this technique for a sample data set in the Fraser TSA appears to meet the constraints specified in the *Forest Practices Code Impact Analysis*.

Table 22. Wildlife tree retention report

Landscape Unit	BEC subzone	WTR (%)
Ainslie	CWHds	14
Ainslie	CWHms	14
Ainslie	ESSFdc	9
Ainslie	ESSFmw	10
Alouette	CWHdm	18
Alouette	CWHvm	17
Alouette	CWHxm	3
Alouette	MHmm	14
Anderson	CWHds	12
Anderson	CWHms	12
Anderson	ESSFmw	9
Anderson	IDFww	9
Anderson	MHmm	8
Big Silver	CWHds	14
Big Silver	CWHms	11
Big Silver	ESSFmw	3
Big Silver	MHmm	7
Chehalis	CWHdm	8
Chehalis	CWHvm	15
Chehalis	MHmm	11
Chilliwack	CWHdm	15
Chilliwack	CWHds	12
Chilliwack	CWHms	13
Chilliwack	CWHvm	11
Chilliwack	CWHxm	12
Chilliwack	MHmm	10

(continued)

Table 22. Wildlife tree retention report

Landscape Unit	BEC subzone	WTR (%)
Coquihalla	CWHds	10
Coquihalla	CWHms	11
Coquihalla	ESSFmw	6
Coquihalla	MHmm	7
Coquitlam	CWHdm	18
Coquitlam	CWHvm	11
Coquitlam	MHmm	3
East Harrison	CWHdm	13
East Harrison	CWHms	11
East Harrison	CWHvm	16
East Harrison	MHmm	9
FraserValleySouth	CWHdm	13
FraserValleySouth	CWHds	10
FraserValleySouth	CWHms	12
FraserValleySouth	CWHvm	13
FraserValleySouth	CWHxm	14
FraserValleySouth	MHmm	12
Hatzic	CWHdm	13
Hatzic	CWHvm	16
Hatzic	MHmm	13
Manning	CWHms	7
Manning	ESSFmw	3
Manning	MHmm	8
Mehatl	CWHds	8
Mehatl	CWHms	4
Mehatl	ESSFmw	4
Mehatl	IDFww	11
Mehatl	MHmm	3
Nahatlatch	CWHds	6
Nahatlatch	CWHms	10
Nahatlatch	ESSFmw	7
Nahatlatch	IDFww	10
Nahatlatch	MHmm	9
Pitt	CWHdm	13
Pitt	CWHvm	15
Pitt	MHmm	7
Silverhope	CWHds	13
Silverhope	CWHms	13
Silverhope	MHmm	7
Spuzzum	CWHds	15
Spuzzum	CWHms	14
Spuzzum	IDFww	14
Spuzzum	MHmm	7
Stave	CWHvm	13
Stave	MHmm	4

(continued)

Table 22. Wildlife tree retention report (concluded)

Landscape Unit	BEC subzone	WTR (%)
Tretheway	CWHdm	17
Tretheway	CWHds	16
Tretheway	CWHms	9
Tretheway	CWHvm	3
Tretheway	MHmm	5
West Harrison	CWHdm	16
West Harrison	CWHds	18
West Harrison	CWHms	11
West Harrison	CWHvm	18
West Harrison	MHmm	16
Widgeon	CWHdm	14
Widgeon	CWHvm	10
Widgeon	MHmm	3
Yale	CWHds	12
Yale	CWHms	13
Yale	CWHvm	17
Yale	MHmm	9

Data source and comments:

This information was drafted on December 14, 2000.

7. Sensitivity Analyses to be Performed

Sensitivity analysis can provide a measure of the timber supply impact if uncertainty in management assumptions and/or data integrity exists. The magnitude of the increase or decrease in a particular variable should reflect the degree of uncertainty surrounding the assumption. For instance, minimum harvestable age may be developed based on some minimum stand attributes which currently appear to dictate the earliest time stands are eligible for harvest. Sensitivity analysis may indicate that a small reduction in these attributes may alleviate anticipated harvest level reductions in the future. By developing and testing a number of sensitivity analyses, it is possible to determine which variables most affect results. Table 23 lists the sensitivity analyses to be undertaken as part of this Timber Supply Review.

Table 23. Sensitivity issues

Issue to be Tested	Sensitivity Levels	Data Source
Minimum harvestable age	Increase minimum volume to 400 m^3/ha	Recent shift by licensees from low volume HB stands
Site index estimate for older stands	Adjust SI by equation provided by Research Branch	Recent OGSI paired plot initiative
Size of the area before forest provides "old" forest characteristics	Extrapolate the size characteristics from the nine completed LUs	MSRM guidance for polygon selection in landscape unit planning
Land base changes	Expand the THLB	Extrapolate a land base increase based on activities in the FDP 2001
Recommended visual quality classes	Use slope class to determine the required green-up height	Procedures for factoring visual resources into timber supply analyses
Harvest flow alternatives	Even-flow	
Examine the implications of variable retention levels on managed plantations	MoF Research Branch modelling on yield impact based on length of retained edge	District staff review of retention levels
Examine the implications of restricting the harvest of isolated timber		District review of minimum size/aggregate volume for operational feasibility
Examine spatial adjacency guidelines	Set a maximum cutblock size	District review of cutblock size and spatial influence